

## CLAIMS

1    1. A file server system for a computer having a processor, a memory coupled to the  
2    processor, and a system bus to which the processor and memory are coupled, the com-  
3    puter being configured to implement a file system, the file server system comprising:  
4                 (A) a storage operating system adapted to be executed by the processor;  
5                 (B) a removable nonvolatile memory device coupled to the system bus, the  
6    removable nonvolatile memory device containing diagnostics code for the system; and  
7                 (C) a set of boot instructions resident in the filer server system including in-  
8    structions for executing a normal boot routine upon a power-on of the system, and in-  
9    cluding instructions enabling the processor to identify the removable nonvolatile memory  
10   device and to load the diagnostics code into the memory in response to a command to  
11   execute a diagnostics boot routine instead of the normal boot routine.

1    2. The system as defined in claim 1 wherein the removable nonvolatile memory de-  
2    vice is a compact flash, the compact flash being divided into a plurality of partitions with  
3    the diagnostics code residing in at least one of the partitions.

1    3. The system as defined in claim 2 wherein one of the partitions of the compact  
2    flash is designated as a maintenance log into which test results and data are stored.

1    4. The system as defined in claim 2 further comprising:  
2                 (A) a input/output device coupled to the system bus, and which input/output  
3    device is identifiable by the processor; and  
4                 (B) a second bus coupled between the input/output device and the compact  
5    flash in such a manner that when the processor identifies the input/output device, the  
6    compact flash is, in turn, initialized and the diagnostics code is executed upon a com-  
7    mand to run a diagnostics boot routine.

1    5. The system of claim 1 further comprising:  
2                 (A) a storage adapter coupled to the system bus; and

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3 at least one storage disk coupled to the storage adapter and containing files served by the  
4 operating system.

1 6. The system as defined in claim 5 further comprising a plurality of storage  
2 disks coupled to the storage adapter and data on the disks being stored in a write any-  
3 where file layout system.

1 7. The system as defined in claim 1 further comprising a motherboard upon  
2 which the processor, the memory and the set of boot instructions reside.

1 8. The system as defined in claim 7 wherein the removable nonvolatile memory de-  
2 vice containing the diagnostics code is resident external to the motherboard, and the di-  
3 agnostics code on the removable nonvolatile memory device is adapted to be upgraded or  
4 amended free of taking the system out of service.

1 9. The system as defined in claim 1 wherein said diagnostic code includes code re-  
2 lating to the diagnostics of hardware devices including the processor, the memory, the  
3 buses, the adapters, the disks, the compact flash and interfaces thereof.

1 10. The system as defined in claim 1 wherein said boot instructions reside in firm-  
2 ware.

1 11. A method of performing diagnostics in a filer server system, the filer server sys-  
2 tem having a processor, a memory coupled to the processor and having memory locations  
3 addressable by the processor, a storage operating system adapted to be executed by the  
4 processor, system firmware containing instructions for power-on self tests, a set of boot  
5 instructions including instructions for executing a normal boot routine upon a power-on  
6 of the system after the power-on self test is completed, the method comprising the steps  
7 of:

8                 (A)     providing a removable nonvolatile memory device interfaced with the  
9     motherboard, the removable nonvolatile memory device being identifiable to the proces-  
10    sor;  
11                 (B)     dividing the removable nonvolatile memory device into separate memory  
12    partitions;  
13                 (C)     storing a set of diagnostics instructions, being a diagnostics code, in one of  
14    the partitions of the removable nonvolatile memory device; and  
15                 (D)     programming the system firmware to recognize a user implemented com-  
16    mand for a diagnostics boot such that in response to the diagnostics boot command, the  
17    firmware loads the diagnostics code residing in the removable nonvolatile memory de-  
18    vice into the memory to execute a diagnostic boot routine instead of a normal boot rou-  
19    tine.

1     12.    The method as defined in claim 11 including the further step of  
2                 (E)     maintaining, in a separate partition of the removable nonvolatile memory  
3     device, a maintenance log into which diagnostic test results data and data about the stor-  
4     age system are stored.

1     13.    The method as defined in claim 11 including the further step of:  
2                 selecting as the removable nonvolatile memory device, a compact flash.

1     14.    The method as defined in claims 11 including the further step of:  
2                 selecting as the removable nonvolatile memory device a personal computer (PC)  
3     card.

1     15.    The method as defined in claim 11 including the further step of:  
2                 upgrading the diagnostics code without taking the file server out of service.

1     16.    A storage system for a computer configured to implement a file system, the stor-  
2     age system having a processor, a memory coupled to the processor and having memory  
3     locations addressable by the processor, a system bus to which the memory and the proc-

4       essor are coupled, an operating system adapted to be executed by the processor, system  
5       firmware containing instructions for power-on self tests and a set of instructions for exe-  
6       cuting a normal boot routine upon a power-on of the system after a power-on self test is  
7       completed, the storage system comprising:

8                 (A)       means for storing a set of diagnostics instructions comprising diagnostics  
9       code, in a removable nonvolatile memory device coupled to the system bus, the remov-  
10      able nonvolatile memory device being identifiable to the system; and

11                 (B)       means for executing the diagnostics code in response to a diagnostics boot  
12      command received by system firmware.

1       17.      The storage system of claim 16 further comprising:

2                 means for coupling the removable nonvolatile memory device to the processor in  
3       such a manner that the diagnostics code may be upgraded without taking the storage sys-  
4       tem out of normal service.

1       18.      The storage system of claim 17, further comprising:

2                 means for upgrading the diagnostics code by interfacing with the storage system  
3       through an associated input/output interface.

1       19.      A computer-readable medium operating on a computer in a network that includes  
2       one or more storage systems sharing volumes, the computer-readable medium including  
3       program instructions for performing the steps of:

4                 (A)       initiating a power-on self test when the computer is powered-on;

5                 (B)       identifying devices present in the computer;

6                 (C)       in response to a successful power-on self test, commencing a normal boot  
7       routine;

8                 (D)       recognizing a command for a diagnostics boot;

9                 (E)       in response to the diagnostics boot command, probing devices to locate a  
10      removable nonvolatile memory device containing diagnostic boot instructions; and

11                 (F)       interrupting the normal boot routine and executing the diagnostics code for  
12      a diagnostics boot for the computer.

1 20. The computer readable medium as defined in claim 19 including the further in-  
2 struction to identify a compact flash as the removable nonvolatile memory device in  
3 which diagnostics code for the computer is stored.

1 21. The computer readable medium as defined in claim 20 including further instruc-  
2 tions to save diagnostics test results and other data in a predetermined address location in  
3 the compact flash associated with the computer.

1 22. The computer readable medium as defined in claim 21 wherein the diagnostics  
2 boot command is initiated by a human maintenance operator.

1 23. The computer readable medium as defined in claim 21 wherein the diagnostics  
2 boot command is initiated as an instruction in the computer readable medium upon the  
3 occurrence of a predetermined event.

1 24. A diagnostic system for use with a storage system comprising:  
2 a removable nonvolatile memory device interconnected with the storage system,  
3 wherein the removable nonvolatile memory device containing boot diagnostic code that  
4 is loadable into the storage system as an alternative to a normal boot routine.

1 25. The diagnostic system of claim 24, wherein the removable nonvolatile memory  
2 device further comprises a plurality of partitions.

1 26. The diagnostics system of claim 25, wherein the boot diagnostic code is contained  
2 within a first partition of the plurality of partitions.

1 27. The diagnostic system of claim 26, wherein the removable nonvolatile memory  
2 device further comprises a second partition, the second partition storing a diagnostic log.

1 28. The diagnostic system of claim 24, wherein the removable nonvolatile memory  
2 device is a PC card.

1       29.     The diagnostic system of claim 24, wherein the removable nonvolatile memory  
2     device is a compact flash.

1       30.     The diagnostic system of claim 24, wherein the storage system further comprises  
2     a firmware boot routine, the firmware boot routine having a process for selecting between  
3     execution of either a normal boot routing or a diagnostic boot routine.

1       31.     A file server system for a computer having a processor, a memory coupled to the  
2     processor, and a system bus to which the processor and memory are coupled, the com-  
3     puter being configured to implement a file system, the file server system comprising:

4               (A)     a storage operating system adapted to be executed by the processor;  
5               (B)     a removable nonvolatile memory device coupled to the system bus, the  
6     removable nonvolatile memory device containing diagnostics code for the system, the  
7     removable nonvolatile memory device also divided into a plurality of partitions with the  
8     diagnostics code residing in at least one of the partitions; and

9               (C)     a set of boot instructions resident in the filer server system including in-  
10   structions for executing a normal boot routine upon a power-on of the system, and in-  
11   cluding instructions enabling the processor to identify the removable nonvolatile memory  
12   device and to load the diagnostics code into the memory in response to a command to  
13   execute a diagnostics boot routine instead of the normal boot routine.

1       32.     The system of claim 29 wherein one of the partitions is designated as a mainte-  
2     nance log into which test results and data are stored.

1       33.     The system of claim 29 further comprising:  
2               a separate storage medium, the separate storage medium storing a boot routine.

1       34.     The system of claim 31, wherein the separate storage medium is a partition on the  
2     removable nonvolatile memory device.